



**[4910-13]**

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR Part 25**

**[Docket No. FAA-2016-7852; Notice No. 25-17-01-SC]**

**Special Conditions:** AmSafe; Non-Rechargeable Lithium Battery Installations.

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Notice of proposed special conditions.

**SUMMARY:** This action proposes special conditions for a supplemental type certificate for installing an inflatable restraint system with non-rechargeable lithium batteries on seats in certain transport category airplanes. These airplanes, as modified by AmSafe, will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport category airplanes. This design feature is a non-rechargeable lithium battery. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These proposed special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

**DATES:** Send your comments on or before **[INSERT DATE 30 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER]**.

**ADDRESSES:** Send comments identified by docket number FAA-2016-7852 using any of the following methods:

- *Federal eRegulations Portal:* Go to <http://www.regulations.gov/> and follow the online instructions for sending your comments electronically.

- *Mail:* Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.
- *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to Docket Operations at 202-493-2251.

*Privacy:* The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket Web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at <http://DocketsInfo.dot.gov/>.

*Docket:* Background documents or comments received may be read at <http://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

**FOR FURTHER INFORMATION CONTACT:** Nazih Khaouly, Airplane and Flight Crew Interface Branch, ANM-111, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington, 98057-3356; telephone 425-227-2432; facsimile 425-227-1149.

## **SUPPLEMENTARY INFORMATION**

### **Future Requests for Installation of Non-Rechargeable Lithium Batteries**

The FAA anticipates that non-rechargeable lithium batteries will be installed in most makes and models of transport category airplanes. We intend to require special conditions for certification projects involving non-rechargeable lithium battery installations to address certain safety issues until we can revise the airworthiness requirements. Applying special conditions to these installations across the range of transport category airplanes will ensure regulatory consistency.

Typically, the FAA issues special conditions after receiving an application for type certificate approval of a novel or unusual design feature. However, the FAA has found that the presence of non-rechargeable lithium batteries in certification projects is not always immediately identifiable, since the battery itself may not be the focus of the project. Meanwhile, the inclusion of these batteries has become virtually ubiquitous on in-production transport category airplanes, which shows that there will be a need for these special conditions. Also, delaying the issuance of special conditions until after each design application is received could lead to costly certification delays. Therefore the FAA finds it necessary to issue special conditions applicable to these battery installations on particular makes and models of aircraft.

On April 22, 2016, the FAA published special conditions no. 25-612-SC in the Federal Register (81 FR 23573) applicable to Gulfstream Aerospace Corporation for the GVI airplane. Those were the first special conditions the FAA issued for non-rechargeable lithium battery installations. We explained in that document our decision to make those special conditions effective one year after publication in the Federal Register, and our intention for other special conditions for other makes and models to be effective on that same date or 30 days after

publication, whichever is later. The effective date of special conditions no. 25-612-SC is April 22, 2017.

Section 1205 of the FAA Reauthorization Act of 1996 requires the FAA to consider the extent to which Alaska is not served by transportation modes other than aviation and to establish appropriate regulatory distinctions when modifying airworthiness regulations that affect intrastate aviation in Alaska. In consideration of this requirement and the overall impact on safety, the FAA does not intend to require non-rechargeable lithium battery special conditions for design changes that only replace a 121.5 megahertz (MHz) emergency locator transmitter (ELT) with a 406 MHz ELT that meets Technical Standard Order C126b, or later revision, on transport airplanes operating only in Alaska. This will support our efforts of encouraging operators in Alaska to upgrade to a 406 MHz ELT. These ELTs provide significantly improved accuracy for lifesaving services to locate an accident site in Alaskan terrain. The FAA considers that the safety benefits from upgrading to a 406 MHz ELT for Alaskan operations will outweigh the battery fire risk.

### **Comments Invited**

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

### **Background**

AmSafe is the holder of supplemental type certificate (STC) no. ST02152LA. This STC is for the installation of an inflatable restraint system with non-rechargeable lithium batteries on

seats in several transport category airplanes. AmSafe periodically applies to amend this STC to expand its applicability to include additional transport category airplane makes and models. The current battery requirements in Title 14, Code of Federal Regulations (14 CFR) part 25 are inadequate for addressing an airplane with non-rechargeable lithium batteries.

### **Type Certification Basis**

Under the provisions of 14 CFR 21.101, AmSafe must show that airplanes for which they make application to modify by STC no. ST02152LA, as changed, continue to meet the applicable provisions of the regulations listed in each airplane's respective type certificate or the applicable regulations in effect on the date of application for the change except for earlier amendments as agreed upon by the FAA.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the airplane model for which they are issued. Should the applicant apply for an STC to modify any other model included on the same type certificate to incorporate the same novel or unusual design feature, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the airplanes modified by STC no. ST02152LA must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.101.

## **Novel or Unusual Design Features**

STC no. ST02152LA is for the installation of an inflatable restraint system that incorporates non-rechargeable lithium batteries, which are a novel or unusual design feature.

For the purpose of these special conditions, we refer to a battery and battery system as a battery. A battery system consists of the battery and any protective, monitoring, and alerting circuitry or hardware inside or outside of the battery. It also includes vents (where necessary) and packaging.

## **Discussion**

The FAA derived the current regulations governing installation of batteries in transport category airplanes from Civil Air Regulations (CAR) 4b.625(d) as part of the recodification of CAR 4b that established 14 CFR part 25 in February 1965. This recodification basically reworded the CAR 4b battery requirements, which are currently in § 25.1353(b)(1) through (4). Non-rechargeable lithium batteries are novel and unusual with respect to the state of technology considered when these requirements were codified. These batteries introduce higher energy levels into airplane systems through new chemical compositions in various battery cell sizes and construction. Interconnection of these cells in battery packs introduces failure modes that require unique design considerations, such as provisions for thermal management.

Recent events involving rechargeable and non-rechargeable lithium batteries prompted the FAA to initiate a broad evaluation of these energy storage technologies. In January 2013, two independent events involving rechargeable lithium-ion batteries revealed unanticipated failure modes. A National Transportation Safety Board (NTSB) letter to the FAA, dated May 22, 2014, which is available at <http://www.nts.gov>, filename A-14-032-036.pdf, describes these events.

On July 12, 2013, an event involving a non-rechargeable lithium battery, in an emergency locator transmitter installation, demonstrated unanticipated failure modes. The United Kingdom's Air Accidents Investigation Branch Bulletin S5/2013 describes this event.

Some known uses of rechargeable and non-rechargeable lithium batteries on airplanes include:

- Flight deck and avionics systems such as displays, global positioning systems, cockpit voice recorders, flight data recorders, underwater locator beacons, navigation computers, integrated avionics computers, satellite network and communication systems, communication management units, and remote-monitor electronic line-replaceable units;
- Cabin safety, entertainment, and communications equipment, including emergency locator transmitters, life rafts, escape slides, seatbelt air bags, cabin management systems, Ethernet switches, routers and media servers, wireless systems, internet and in-flight entertainment systems, satellite televisions, remotes, and handsets;
- Systems in cargo areas including door controls, sensors, video surveillance equipment, and security systems.

Some known potential hazards and failure modes associated with non-rechargeable lithium batteries are:

- Internal failures: In general, these batteries are significantly more susceptible to internal failures that can result in self-sustaining increases in temperature and pressure (i.e., thermal runaway) than their nickel-cadmium or lead-acid counterparts. The metallic lithium can ignite, resulting in a self-sustaining fire or explosion.

- Fast or imbalanced discharging: Fast discharging or an imbalanced discharge of one cell of a multi-cell battery may create an overheating condition that results in an uncontrollable venting condition, which in turn leads to a thermal event or an explosion.
- Flammability: Unlike nickel-cadmium and lead-acid batteries, lithium batteries use higher energy and current in an electrochemical system that can be configured to maximize energy storage of lithium. They also use liquid electrolytes that can be extremely flammable. The electrolyte, as well as the electrodes, can serve as a source of fuel for an external fire if the battery casing is breached.

Proposed special condition no. 1 of these special conditions requires that each individual cell within a non-rechargeable lithium battery be designed to maintain safe temperatures and pressures. Proposed special condition no. 2 addresses these same issues but for the entire battery. Proposed special condition no. 2 requires the battery be designed to prevent propagation of a thermal event, such as self-sustained, uncontrollable increases in temperature or pressure from one cell to adjacent cells.

Proposed special condition nos. 1 and 2 are intended to ensure that the non-rechargeable lithium battery and its cells are designed to eliminate the potential for uncontrollable failures. However, a certain number of failures will occur due to various factors beyond the control of the battery designer. Therefore, other special conditions are intended to protect the airplane and its occupants if failure occurs.

Proposed special condition nos. 3, 7, and 8 are self-explanatory.

The FAA proposes special condition no. 4 to make it clear that the flammable fluid fire protection requirements of § 25.863 apply to non-rechargeable lithium battery installations. Section 25.863 is applicable to areas of the airplane that could be exposed to flammable fluid



leakage from airplane systems. Non-rechargeable lithium batteries contain an electrolyte that is a flammable fluid.

Proposed special condition no. 5 requires that each non-rechargeable lithium battery installation not damage surrounding structure or adjacent systems, equipment, or electrical wiring from corrosive fluids or gases that may escape in such a way as to cause a major or more severe failure condition.

While proposed special condition no. 5 addresses corrosive fluids and gases, special condition no. 6 addresses heat. Proposed special condition no. 6 requires that each non-rechargeable lithium battery installation have provisions to prevent any hazardous effect on airplane structure or systems caused by the maximum amount of heat the battery installation can generate due to any failure of it or its individual cells. The means of meeting special conditions nos. 5 and 6 may be the same, but the requirements are independent and address different hazards.

These proposed special conditions apply in lieu of § 25.1353(b)(1) through (4) at Amendment 25-123 for the installation of inflatable restraint systems with non-rechargeable lithium batteries on the seats of the subject airplanes. Sections 25.1353(b)(1) through (4) at Amendment 25-123 remain in effect for other battery installations on these airplanes.

These proposed special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

### **Applicability**

These special conditions are applicable to the airplane models listed on the approved model list (AML) of STC no. ST02152LA, which is available at [rgl.faa.gov](http://rgl.faa.gov). Should AmSafe

apply at a later date for a change to STC no. ST02152LA to include any other model on the AML to incorporate the same novel or unusual design feature, these special conditions would apply to that model as well. Should AmSafe apply at a later date for another STC to modify any other model included on the type certificates of the models on the STC no. ST02152LA AML to incorporate the same novel or unusual design feature, these special conditions would also apply to that model as well.

These special conditions are only applicable to design changes applied for after its effective date.

These special conditions are not applicable to changes to previously certified non-rechargeable lithium battery installations where the only change is either cosmetic or to relocate the installation to improve the safety of the airplane and occupants. A cosmetic change is a change in appearance only, and does not change any function or safety characteristic of the battery installation. These special conditions are also not applicable to unchanged, previously certified non-rechargeable lithium battery installations that are affected by a change in a manner that improves the safety of its installation. The FAA determined that these exclusions are in the public interest because the need to meet all of the special conditions might otherwise deter these design changes that improve safety.

## **Conclusion**

This action only affects the installation of inflatable restraint systems with non-rechargeable lithium batteries on seats on the airplane models listed on the AML of STC no. ST02152LA. It is not a rule of general applicability and affects only the applicant who will apply to the FAA for approval of these features on the airplane.

## **List of Subjects in 14 CFR Part 25**

Aircraft, Aviation safety, Reporting and record keeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

## **The Proposed Special Conditions**

Accordingly, the FAA proposes the following special conditions as part of the type certification basis for airplane models listed on the approved model list of supplemental type certificate no. ST02152LA, modified by AmSafe.

## **Non-Rechargeable Lithium Battery Installations**

In lieu of § 25.1353(b)(1) through (4) at Amendment 25-123, each non-rechargeable lithium battery installation must:

1. Be designed to maintain safe cell temperatures and pressures under all foreseeable operating conditions to prevent fire and explosion.
2. Be designed to prevent the occurrence of self-sustaining, uncontrollable increases in temperature or pressure.
3. Not emit explosive or toxic gases, either in normal operation or as a result of its failure, that may accumulate in hazardous quantities within the airplane.
4. Meet the requirements of § 25.863.
5. Not damage surrounding structure or adjacent systems, equipment, or electrical wiring from corrosive fluids or gases that may escape in such a way as to cause a major or more severe failure condition.

6. Have provisions to prevent any hazardous effect on airplane structure or systems caused by the maximum amount of heat it can generate due to any failure of it or its individual cells.
7. Have a failure sensing and warning system to alert the flightcrew if its failure affects safe operation of the airplane.
8. Have a means for the flightcrew or maintenance personnel to determine the battery charge state if the battery's function is required for safe operation of the airplane.

**Note:** A battery system consists of the battery and any protective, monitoring, and alerting circuitry or hardware inside or outside of the battery. It also includes vents (where necessary) and packaging. For the purpose of these special conditions, a “battery” and “battery system” are referred to as a battery.

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